PREPARATION OF ENAMELS.

The base of enamel is glass, colored different shades by the addition of metallic oxides mixed and melted with it.

The oxide of cobalt produces blue; red is obtained by the Cassius process. The purple of Cassius, which is one of the most brilliant of colors, is used almost exclusively in enameling and miniature painting; it is produced by adding to a solution of gold chloride a solution of tin chloride mixed with ferric chloride until a green color appears. The oxide of iron and of copper also produces red, but of a less rich tone; chrome produces green, and manganese violet; black is produced by the mixture of these oxides. Antimony and arsenic also enter into the composition of enamels.

Enamels are of two classes—opaque and transparent. The opacity is caused by the presence of tin.

When the mingled glass and oxides have been put in the crucible, this is placed in the furnace, heated to a temperature of 1,832° or 2,200° F. When the mixture becomes fused, it is stirred with a metal rod. Two or three hours are necessary for the operation. The enamel is then poured into water, which divides it into grains, or formed into cakes or masses, which are left to cool.

For applying enamels to metals, gold, silver, or copper, it is necessary to reduce them to powder, which is effected in an agate mortar with the aid of a pestle of the same material. During the operation the enamel ought to be soaked in water.

For dissolving the impurities which may have been formed during the work, a few drops of nitric acid are poured in immediately afterwards, well mixed, and then got rid of by repeated washing with filtered water. This should be carefully done, stirring the enamel powder with a glass rod, in order to keep the particles in suspension.

The powder is allowed to repose at the bottom of the vessel, after making sure by the taste of the water that it does not contain any trace of acid; only then is the enamel ready for use.

For enameling a jewel or other object it is necessary, first to heat it strongly, in order to burn off any fatty matter, and afterwards to cleanse it in a solution of nitric acid diluted with boiling water. After rinsing with pure water and wiping with a very clean cloth, it is heated slightly and is then ready to receive the enamel.

Enamels are applied with a steel tool in the form of a spatula; water is the vehicle. When the layers of enamel have been applied, the contained water is removed by means of a fine linen rag, pressing slightly on the parts that have received the enamel. The tissue absorbs the water, and nothing remains on the object except the enamel powder. It is placed before the fire to remove every trace of moisture. Thus prepared and put on a fire-clap slab, it is ready for its passage to the heat which fixes the enamel. This operation is conducted in a furnace, with a current of air whose temperature is about 1,832° F. In this operation the fire-chamber ought not to contain any gas.

Enamels are fused at a temperature of 1,292° to 1,472° F. Great attention is needed, for experience alone is the guide, and the duration of the process is quite short. On coming from the fire, the molecules composing the enamel powder have been fused together and present to the eye a vitreous surface covering the metal and adhering to it perfectly. Under the action of the heat the metallic oxides contained in the enamel have met the oxide of the metal and formed one body with it, thus adhering completely.

JEWELERS' ENAMELS.

Melt together:

Transparent Red.—Cassius gold purple, 65 parts, by weight; crystal glass, 30 parts, by weight; borax, 4 parts, by weight.

Transparent Blue.—Crystal glass, 34 parts, by weight; borax, 6 parts, by weight; cobalt oxide, 4 parts, by weight.

Dark Blue.—Crystal glass, 30 parts, by weight; borax, 6 parts, by weight; cobalt oxide, 4 parts, by weight; bone black, 4 parts, by weight; arsenic acid, 2 parts, by weight.

Transparent Green.—Crystal glass, 80 parts, by weight; cupric oxide, 4 parts, by weight; borax, 2 parts, by weight.

Dark Green.—Crystal glass, 30 parts, by weight; borax, 8 parts, by weight; cupric oxide, 4 parts, by weight; bone black, 4 parts by weight; arsenic acid, 2 parts, by weight.

Black.—Crystal glass, 30 parts, by weight; borax, 8 parts, by weight; cupric oxide, 4 parts, by weight; ferric oxide, 3 parts, by weight; cobalt oxide, 4 parts, by weight; manganic oxide, 4 parts, by weight.

White.—I.—Crystal glass, 30 parts, by weight; stannic oxide, 6 parts, by weight; borax, 6 parts, by weight; arsenic acid, 2 parts, by weight.

II.—Crystal glass, 30 parts, by weight; sodium antimonate, 10 parts, by weight.

The finely pulverized colored enamel is applied with a brush and lavender oil on the white enamel already fused in and then only heated until it melts. For certain purposes, the color compositions may also be fused in without a white ground. The glass used for white, No. 2, must be free from lead, otherwise the enamel will be unsightly.

Various Enamels for Precious Metals: White.—Crystal glass, 30 parts, by weight; oxide of tin, 6 parts, by weight; borax, 6 parts, by weight; dioxide of arsenic, 2 parts, by weight, or silicious sand, 50 parts, by weight; powder, consisting of 15 of tin per 100 of lead, 100 parts, by weight; carbonate of potassium, 40 parts, by weight. Fuse the whole with a quantity of manganese. To take away the accidental coloring, pour it into water, and after having pulverized it, melt again 3 or 4 times.

Opaque Blue.—Crystal glass, 30 parts, by weight; borax, 6 parts, by weight; cobalt oxide, 4 parts, by weight; calcined bone, 4 parts, by weight; dioxide of arsenic, 2 parts, by weight.

Transparent Green.—Crystal glass, 30 parts, by weight; blue verditer, 4 parts, by weight; borax, 2 parts, by weight.

Opaque Green.—Crystal glass, 30 parts, by weight; borax, 8 parts, by weight; blue verditer, 4 parts, by weight; calcined bone, 4 parts, by weight; dioxide of arsenic, 2 parts, by weight.

Black.—I.—Crystal glass, 30 parts, by weight; borax, 8 parts, by weight; oxide of copper, 4 parts, by weight; oxide of iron, 3 parts, by weight; oxide of cobalt, 4 parts, by weight; oxide of manganese, 4 parts, by weight.

II.—Take ½ part, by weight, of silver; 2½ parts of copper; 3½ parts of lead, and 2½ parts of muriate of ammonia. Melt together and pour into a crucible with twice as much pulverized sulphur; the crucible is then to be immediately covered that the sulphur may not take fire, and the mixture is to be calcined over a smelting fire until the superfluous sulphur is burned away. The compound is then to be coarsely pounded, and, with a solution of muriate of ammonia, to be formed into a paste which is to be placed upon the article it is designed to enamel. The article must then be held over a spirit lamp till the compound upon it melts and flows. After this it may be smoothed and polished up in safety.

See also Varnishes and Ceramics for other enamel formulas.

ENAMEL COLORS, QUICK DRYING:
See Varnishes.

ENAMEL REMOVERS:
See Cleaning Preparations and Methods.

ENAMELING ALLOYS:
See Alloys.

ENGINES (GASOLINE), ANTI-FREEZING SOLUTION FOR:
See Freezing Preventives.

ENGRAVING SPOON HANDLES.

After the first monogram has been engraved, rub it with a mixture of 3 parts of beeswax, 3 of tallow, 1 of Canada balsam, and 1 of olive oil. Remove any superfluous quantity, then moisten a piece of paper with the tongue, and press it evenly upon the engraving. Lay a dry piece of paper over it, hold both firmly with thumb and forefinger of left hand, and rub over the surface with a polishing tool of steel or bone. The wet paper is thereby pressed into the engraving, and, with care, a clear impression is made. Remove the paper carefully, place it in the same position on another handle, and a clear impression will be left. The same paper can be used 2 dozen times or more.

ENGRAVING ON STEEL:
See Steel.

Engravings: Their Preservation

(See also Pictures, Prints, and Lithographs.)

Cleaning of Copperplate Engravings.—Wash the sheet on both sides by means of a soft sponge or brush with water to which 40 parts of ammonium carbonate has been added per 1,000 parts of water, and rinse the paper each time with clear water. Next moisten with water in which a little wine vinegar has been admixed, rinse the sheet again with water containing a little chloride of lime, and dry in the air, preferably in the sun. The paper will become perfectly clear without the print being injured.

Restoration of Old Prints.—Old engravings, woodcuts, or printed sheets that have turned yellow may be rendered white by first washing carefully in water containing a little hyposulphite of soda, and then dipping for a minute in javelle water. To prepare the latter, put 4 pounds of bicarbonate of soda in a pan, pour over it 1 gallon of boiling water; boil for 15 minutes, then stir in 1

pound of chloride of lime. When cold, pour off the clear liquid, and keep in a jug ready for use.

Surprising results are obtained from the use of hydrogen peroxide in the restoration of old copper or steel engravings or lithographs which have become soiled or yellow, and this without the least injury to the picture. The cellulose which makes the substance of the paper resists the action of ozone, and the black carbon color of these prints is indestructible.

To remove grease or other spots of dirt before bleaching, the engravings are treated with benzine. This is done by laying each one out flat in a shallow vessel and pouring the benzine over it. As benzine evaporates very rapidly, the vessel must be kept well covered, and since its vapors are also exceedingly inflammable, no fire or smoking should be allowed in the room. The picture is left for several hours, then lifted out and dried in the air, and finally brushed several times with a soft brush. The dust which was kept upon the paper by the grease now lies more loosely upon it and can easily be removed by brushing.

In many cases the above treatment is sufficient to improve the appearance of the picture. In the case of very old or badly soiled engravings, it is followed by a second, consisting in the immersion of the picture in a solution of sodium carbonate or a very dilute solution of caustic soda, it being left as before for several hours. After the liquid has been poured off, the picture must be repeatedly rinsed in clear water, to remove any remnant of the soda.

By these means the paper is so far cleansed that only spots of mold or other discolorations remain. These may be removed by hydrogen peroxide, in a fairly strong solution. The commercial peroxide may be diluted with 2 parts water.

The picture is laid in a shallow vessel, the peroxide poured over it, and the vessel placed in a strong light. Very soon the discolorations will pale.

To Reduce Engravings.—Plaster casts, as we know, can be perceptibly reduced in size by treatment with water or alcohol, and if this is properly done, the reduction is so even that the cast loses nothing of its clear outline, but sometimes even gains in this respect by contraction. If it is desired to reduce an engraved plate, make a plaster cast of it, treat this with water or alcohol, and fill the new cast with some easily fusible metal. This model, which will be considerably smaller than the original, is to be made again in plaster, and again treated, until the desired size is reached. In this way anything of the kind, even medallions, can be reproduced on a smaller scale.

ENLARGEMENTS:
See Photography.

ENVELOPE GUM:
See Adhesives, under Mucilages.

EPIZOOTY:
See Veterinary Formulas.

Essences and Extracts of Fruits

Preservation of Fruit Juices.—The juices of pulpy fruits, when fresh, contain an active principle known as pectin, which is the coagulating substance that forms the basis of fruit jellies. This it is which prevents the juice of berries and similar fruits from passing through filtering media. Pectin may be precipitated by the addition of alcohol, or by fermentation. The latter is the best, as the addition of alcohol to the fresh juices destroys their aroma and injures the taste. The induction of a light fermentation is far the better method, not only preserving, when carefully conducted, the taste and aroma of the fruit, but yielding far more juice. The fruit is crushed and the juice subsequently carefully but strongly pressed out. Sometimes the crushed fruit is allowed to stand awhile, and to proceed to a light fermentation before pressure is applied; but while a greater amount of juice is thus obtained, the aroma and flavor of the product are very sensibly injured by the procedure.

To the juice thus obtained, add from 1 to 2 per cent of sugar, and put away in a cool place (where the temperature will not rise over 70° or 75° F.). Fermentation soon begins, and will proceed for a few days. As soon as the development of carbonic acid gas ceases, the juice begins to clear itself, from the surface downward, and in a short time all solid matter will lie in a mass at the bottom, leaving the liquid bright and clear. Draw off the latter with a siphon, very carefully, so as not to disturb the sedimentary matter. Fermentation should be induced in closed vessels only, as when conducted in open containers a fungoid growth is apt to form on the surface, sometimes causing putrefactive, and at others, an acetic, fermentation, in either event spoiling the juice for sub-

sequent use, except as a vinegar. The vessels, to effect the end desired, should be filled only two-thirds or three-fourths full, and then carefully closed with a tight-fitting cork, through which is passed a tube of glass, bent at the upper end, the short end of which passes below the surface of a vessel filled with water. As soon as fermentation commences the carbonic acid developed thereby escapes through the tube into the water, whence it passes off into the atmosphere. When bubbles no longer pass off from the tube the operation should be interrupted, and decantation or siphoning, with subsequent filtration, commenced.

By proceeding in this manner all the aroma and flavor of the juices are retained. If it is intended for preservation for any length of time the juice should be heated on a water bath to about 176° F. and poured, while hot, into bottles which have been asepticized by filling with cold water, and placing in a vessel similarly filled, bringing to a boiling temperature, and maintaining at this temperature until the juice, while still hot, is poured into them. If now closed with corks similarly asepticized, or by dipping into hot melted paraffine, the juice may be kept unaltered for years. It is better, however, to make the juice at once into syrup, using the best refined sugar, and boiling in a copper kettle (iron or tin spoil the color), following the usual precautions as to skimming, etc. The syrup should be poured hot into the bottles previously heated as before described.

Ripe fruit may be kept in suitable quantities for a considerable time if covered with a solution of saccharine and left undisturbed, this, too, without deteriorating the taste, color, or aroma of the fruit if packed with care.

Whole fruit may be stored in bulk, by carefully and without fracture filling into convenient-sized jars or bottles, and pouring thereon a solution containing a quarter of an ounce of refined saccharine to the gallon of water, so filling each vessel that the solution is within an inch of the cork when pressed into position. The corks should first of all be immersed in melted paraffine wax, then drained, and allowed to cool. When fruit juices alone are required for storage purposes they are prepared by subjecting the juicy fruits to considerable pressure, by which process the juices are liberated.

The sound ripe fruits are crushed and packed into felt or flannel bags. The fruit should be carefully selected, rotten or impaired portions being carefully removed; this is important, or the whole stock would be spoiled. Several methods are adopted for preserving and clarifying fruit juices.

A common way in which they are kept from fermenting is by the use of salicylic acid or other antiseptic substance, which destroys the fermentative germ, or otherwise retards its action for a considerable time. The use of this acid is seriously objected to by some as injurious to the consumer. About 2 ounces of salicylic acid, previously dissolved in alcohol, to 25 gallons of juice, or 40 grains to the gallon, is generally considered the proper proportion.

Another method adopted is to fill the freshly prepared cold juice into bottles until it reaches the necks, and on the top of this fruit juice a little glycerine is placed.

Juices thus preserved will keep in an unchanged condition in any season. Probably one of the best methods of preserving fruit juices is to add 15 per cent of 95 per cent alcohol. On such an addition, albumen and mucilaginous matter will be deposited. The juice may then be stored in large bottles, jars, or barrels, if securely closed, and when clear, so that further clarification is unnecessary, the juice should finally be decanted or siphoned off.

A method applicable to most berries is as follows:

Take fresh, ripe berries, stem them, and rub through a No. 8 sieve, rejecting all soft and green fruit. Add to each gallon of pulp thus obtained 8 pounds of granulated sugar. Put on the fire and bring just to a boil, stirring constantly. Just before removing from the fire, add to each gallon 1 ounce of a saturated alcoholic solution of salicylic acid, stirring well. Remove the scum, and, while still hot, put into jars and hermetically seal. Put the jars in cold water, and raise them to the boiling point, to prevent them from bursting by sudden expansion on pouring hot fruit into them. Fill the jars entirely full, so as to leave no air space when fruit cools and contracts.

Prevention of Foaming and Partial Caramelization of Fruit Juices.—Fresh fruit juices carry a notable amount of free carbonic acid, which must make its escape on heating the liquid. This will do easily enough if the juice be heated in its natural state, but the addition of the sugar so increases the density of the fluid that the acid finds escape difficult, and often the result is foaming. As to the burning or partial caramelization of

the syrup, that is easily accounted for in the greater density of the syrup at the bottom of the kettle—the lighter portion, or that still carrying imprisoned gases, remaining on top until it is freed from them. Constant stirring can prevent this only partially, since it cannot entirely overcome the results of the natural forces in action. The consequence is more or less caramelization. The remedy is very simple. Boil the juices first, adding distilled water to make up for the loss by evaporation, and add the sugar afterwards.

ESSENCES AND EXTRACTS:

Almond Extracts.—

I.—Oil of bitter almonds 90 minims
Alcohol, 94 per cent, quantity sufficient to make 8 ounces.

II.—Oil of bitter almonds 80 minims
Alcohol..... 7 ounces
Distilled water, quantity sufficient to make 8 ounces.

III.—Oil of bitter almonds, deprived of its hydrocyanic acid..... 1 ounce
Alcohol..... 15 ounces

In order to remove the hydrocyanic acid in oil of bitter almonds, dissolve 2 parts of ferrous sulphate in 16 parts of distilled water; in another vessel slake 1 part freshly burned quicklime in a similar quantity of distilled water, and to this add the solution of iron sulphate, after the same has cooled. In the mixture put 4 parts of almond oil, and thoroughly agitate the liquids together. Repeat the agitation at an interval of 5 minutes, then filter. Put the filtrate into a glass retort and distil until all the oil has passed over. Remove any water that may be with the distillate by decantation, or otherwise.

Apricot Extract.—

Linalyl formate..... 90 minims
Glycerine..... 1 ounce
Amyl valerianate..... 4 drachms
Alcohol..... 11 ounces
Fluid extract orris... 1 ounce
Water, quantity sufficient to make 1 pint.

Apple Extract.—

Glycerine..... 1 ounce
Amyl valerianate..... 4 drachms
Linalyl formate..... 45 minims
Fluid extract orris.... 1 ounce
Alcohol..... 11 ounces
Water, quantity sufficient to make 1 pint.

Apple Syrup.—I.—Peel and remove the cores of, say, 5 parts of apples and cut them into little bits. Put in a suitable vessel and pour over them a mixture of 5 parts each of common white wine and water, and let macerate together for 5 days at from 125° to 135° F., the vessel being closed during the time. Then strain the liquid through a linen cloth, using gentle pressure on the solid matter, forcing as much as possible of it through the cloth. Boil 30 parts of sugar and 20 parts of water together, and when boiling add to the resulting syrup the apple juice; let it boil up for a minute or so, and strain through flannel.

II.—Good ripe apples are cut into small pieces and pounded to a pulp in a mortar of any metal with the exception of iron. To 1 part of this pulp add 11 parts of water. Allow this to stand for 12 hours. Colate. To 11 parts of the colature add 1 part of sugar. Boil for 5 minutes. Skim carefully. Bottle slightly warm. A small quantity of tartaric acid may be added to heighten the flavor.

Banana Syrup.—Cut the fruit in slices and place in a jar; sprinkle with sugar and cover the jar, which is then enveloped in straw and placed in cold water and the latter is heated to the boiling point. The jar is then removed, allowed to cool, and the juice poured into bottles.

Cinnamon Essence.—

Oil of cinnamon..... 2 drachms
Cinnamon, powdered 4 ounces
Alcohol, deodorized.. 16 ounces
Distilled water..... 16 ounces

Dissolve the oil in the alcohol, and add the water, an ounce at a time, with agitation after each addition. Moisten the cinnamon with a little of the water, add, and agitate. Cork tightly, and put in a warm place, to macerate, 2 weeks, giving the flask a vigorous agitation several times a day. Finally, filter through paper, and keep in small vials, tightly stoppered.

Chocolate Extract.—Probably the best form of chocolate extract is made as follows:

Curaçao cocoa..... 400 parts
Vanilla, chopped fine..... 1 part
Alcohol of 55 per cent..... 2,000 parts

Mix and macerate together for 15 days, express and set aside. Pack the residue in a percolator, and pour on boiling water (soft) and percolate until 575 parts pass through. Put the percolate

in a flask, cork, and let cool, then mix with the alcoholic extract. If it be desired to make a syrup, before mixing the extract, add 1,000 parts of sugar to the percolate, and with gentle heat dissolve the sugar. Mix the syrup thus formed, after cooling, with the alcoholic extract.

Coffee Extracts.—In making coffee extract, care must be used to avoid extracting the bitter properties of the coffee, as this is where most manufacturers fail; in trying to get a strong extract they succeed only in getting a bitter one.

I.—The coffee should be a mixture of Mocha, 3 parts; Old Government Java, 5 parts; or, as some prefer, Mocha, 3 parts; Java, 3 parts; best old Rio, 2 parts.

Coffee, freshly roasted and pulverized.....	100 parts
Boiling water.....	600 parts

Pack the coffee, moistened with boiling water, in a strainer, or dipper, placed in a vessel standing in the water bath at boiling point, and let 400 parts of the water, in active ebullition, pass slowly through it. Draw off the liquid as quickly as possible (best into a vessel previously heated by boiling water to nearly the boiling point), add 200 parts of boiling water, and pass the whole again through the strainer (the container remaining in the water bath). Remove from the bath; add 540 parts of sugar, and dissolve by agitation while still hot.

II.—The following is based upon Liebig's method of making coffee for table use: Moisten 50 parts of coffee, freshly roasted and powdered as before, with cold water, and add to it a little egg albumen and stir in. Pour over the whole 400 parts of boiling water, set on the fire, and let come to a boil. As the liquid foams, stir down with a spoon, but let it come to a boil for a moment; add a little cold water, cover tightly, and set aside in a warm place. Exhaust the residual coffee with 300 parts of boiling water, as detailed in the first process, and to the filtrate add carefully the now clarified extract, up to 600 parts, by adding boiling water. Proceed to make the syrup by the method detailed above.

III.—To make a more permanent extract of coffee saturate 600 parts of freshly roasted coffee, ground moderately fine, with any desired quantity of a 1 in 3 mixture of alcohol of 94 per cent and distilled water, and pack in a percolator. Close the faucet and let stand, closely stoppered, for 24 hours; then pour on the residue of the alcohol and water, and let run through, adding sufficient water, at the last, so as to compensate for what boils away. Set this aside, and continue the percolation, with boiling water, until the powder is exhausted. Evaporate the resultant percolate down to the consistency of the alcoholic extract, and mix the two. If desired, the result may be evaporated down to condition of an extract. To dissolve, add boiling water.

IV.—This essence is expressly adapted to boiling purposes. Take 3 pounds of good coffee, 4 ounces of granulated sugar, 4 pints of pure alcohol, 6 pints of hot water. Have coffee fresh roasted and of a medium grinding. Pack in a glass percolator, and percolate it with a menstruum, consisting of the water and the alcohol. Repeat the percolation until the desired strength is obtained, or the coffee exhausted; then add the sugar and filter.

V.—Mocha coffee.....	1 pound
Java coffee.....	1 pound
Glycerine, quantity sufficient.	
Water, quantity sufficient.	

Grind the two coffees fine, and mix, then moisten with a mixture of 1 part of glycerine and 3 parts of water, and pack in a glass percolator, and percolate slowly until 30 ounces of the percolate is obtained. It is a more complete extraction if the menstruum be poured on in the condition of boiling, and it be allowed to macerate for 20 minutes before percolation commences. Coffee extract should, by preference, be made in a glass percolator. A glycerine menstruum is preferable to one of dilute alcohol, giving a finer product.

VI.—Coffee, Java, roasted, No. 20 powder.....	4 ounces
Glycerine, pure....	4 fluidounces
Water, quantity sufficient.	
Boiling, quantity sufficient.	

Moisten the coffee slightly with water, and pack firmly in a tin percolator; pour on water, gradually, until 4 fluidounces are obtained, then set aside. Place the coffee in a clean tin vessel, with 8 fluidounces of water, and boil for 5 minutes. Again place the coffee in the percolator with the water (infusion), and when the liquid has passed, or drained off, pack the grounds firmly, and pour on boiling water until 8 fluidounces are obtained. When cold, mix the first product, and add the glycerine, bottle, and cork well.

The excellence of this extract of coffee, from the manner of its preparation, will be found by experience to be incomparably superior to that made by the for-

mulas usually recommended, the reason being apparent in the first step in the process.

Coffee Essence.—

Best ground Mocha coffee	4 pounds
Best ground chicory	2 pounds

Boil with 2 gallons of water in a closed vessel and when cold, strain, press, and make up to 2 gallons, and to this add

Rectified spirit of wine	8 ounces
Pure glycerine (fluid)	16 ounces

Add syrup enough to make 4 gallons, and mix intimately.

Cucumber Essence.—Press the juice from cucumbers, mix with an equal volume of alcohol and distil. If the distillate is not sufficiently perfumed, more juice may be added and the mixture distilled. It is said that the essence thus prepared will not spoil when mixed with fats in the preparation of cosmetics.

Fruit Jelly Extract.—Fill into separate paper bags:

Medium finely powdered gelatin	18 parts
Medium finely powdered citric acid	3 parts

Likewise into a glass bottle a mixture of any desired

Fruit essence	1 part
Spirit of wine	1 part

and dissolve in the mixture for obtaining the desired color, raspberry red or lemon yellow, $\frac{1}{10}$ part.

For use, dissolve the gelatin and the citric acid in boiling water, adding

Sugar	125 parts

and mixing before cooling with the fruit essence mixture.

Ginger Extracts.—The following is an excellent method of preparing a soluble essence or extract of ginger:

I.—Jamaica ginger	24 ounces
Rectified spirits, 60 per cent	45 ounces
Water	15 ounces

Mix and let macerate together with frequent agitations for 10 days, then percolate, press off, and filter. The yield should be 45 ounces. Of this take 40 ounces and mix with an equal amount of distilled water. Dissolve 6 drachms of sodium phosphate in 5 ounces of boiling water; let cool and add the solution to the filtrate and water, mixing well. Add 2 drachms of calcium chloride dissolved in 5 ounces of water, nearly cold, and again thoroughly shake the whole. Let stand for 12 hours; then filter.

Put the filtrate in a still, and distil off, at as slow a temperature as possible, 30 ounces. Set this distillate to one side, and continue the distillation till another 40 ounces have passed, then let the still cool. The residue in the still, some 18 ounces, is the desired essence. Pour out all that is possible and wash the still with the 30 ounces of distillate first set aside. This takes up all that is essential. Finally, filter once more, through double filter paper and preserve the filtrate—about 40 ounces, of an amber-colored liquid containing all of the essentials of Jamaica ginger.

Soluble Essence of Ginger.—II.—The following is Harrop's method of proceeding:

Fluid extract of ginger (U. S.)	4 ounces
Pumice, in moderately fine powder	1 ounce
Water enough to make	12 ounces

Pour the fluid extract into a bottle, add the pumice and shake the mixture and repeat the shaking in the course of several hours. Now add the water in proportion of about 2 ounces, shaking well and frequently after each addition. When all is added repeat the agitation occasionally during 24 hours, then filter, returning the last portion of the filtrate until it comes through clear, and if necessary add sufficient water to make 12 ounces.

III.—Jamaica ginger, ground	2 pounds
Pumice stone, ground	2 ounces
Lime, slaked	2 ounces
Alcohol, dilute	4 pints

Rub the ginger with the pumice stone and lime until thoroughly mixed. Moisten with the dilute alcohol until saturated and place in a narrow percolator, being careful not to use force in packing, but simply putting it in to obtain the position of a powder to be percolated, so that the menstruum will go through uniformly. Finally, add the dilute alcohol and proceed until 4 pints of percolate are obtained. Allow the liquid to stand for 24 hours; then filter if necessary.

IV.—Tincture ginger	480 parts
Tincture capsicum	12 parts
Oleoresin ginger	8 parts
Magnesium carbonate	16 parts

Rub the oleoresin with the magnesia, and add the tinctures; add about 400

parts of water, in divided portions, stirring vigorously the while. Transfer the mixture to a bottle, and allow to stand 1 week, shaking frequently; then filter, and make up 960 parts with water.

V.—Fluid extract of ginger (U. S. P.)..... 4 ounces
Pumice, powdered and washed..... 1 ounce
Water enough to make 12 ounces

Pour the fluid extract of ginger into a bottle, and add the pumice, shake thoroughly, set aside, and repeat the operation in the course of several hours. Add the water, in the proportion of about 2 ounces at a time, agitating vigorously after each addition. When all is added, repeat the agitation occasionally during 24 hours, then filter, returning the first portion of the filtrate until it comes through bright and clear. If necessary, pass water through the filter, enough to make 12 fluidounces of filtrate.

VI.—Strongest tincture of ginger..... 1 pint
Fresh slaked lime. 1½ ounces
Salt of tartar..... ¼ ounce

VII.—Jamaica ginger, ground..... 32 parts
Pumice stone, powdered..... 32 parts
Lime, slaked..... 2 parts
Alcohol, dilute, sufficient to make 32 parts

Rub the ginger with the pumice stone and lime, then moisten with alcohol until it is saturated with it. Put in a narrow percolator, using no force in packing. Allow the mass to stand for 24 hours, then let run through. Filter if necessary.

VIII.—The following is insoluble:

Cochin ginger, cut fine..... 1,000 parts
Alcohol, 95 per cent..... 2,500 parts
Water..... 1,250 parts
Glycerine..... 250 parts

Digest together for 8 days in a very warm, not to say hot, place. Decant, press off the roots, and add to the colature, then filter through paper. This makes a strong, natural tasting essence.

IX.—**Green Ginger Extract.**—The green ginger root is freed from the epidermis and surface dried by exposure to the air for a few hours. It is then cut into thin slices and macerated for some days with an equal weight of rectified spirit, which when filtered will yield an essence possessing a very fine aroma and forming an almost perfectly clear solution in water. If the ginger is allowed to dry more than the few hours mentioned it will not produce a soluble essence. It is used in some of the imported ginger ales as a flavoring only, and makes a lovely ginger flavor.

Hop Syrup.—A palatable preparation not inferior to many of the so-called hop bitters:

Hops..... 2 parts
Dandelion..... 2 parts
Gentian..... 2 parts
Chamomile..... 2 parts
Stillingia..... 2 parts
Orange peel..... 2 parts
Alcohol..... 75 parts
Water..... 75 parts
Syrup, simple..... 50 parts

Coarsely powder the drugs and exhaust with the water and alcohol mixed. Decant, press out and filter, and finally add the syrup. The dose is a wineglassful 2 or 3 times daily.

Lemon Essences.—I.—Macerate the cut-up fresh peelings of 40 lemons and 30 China oranges in 8 quarts of alcohol and 2 quarts of water, for 2 or 3 days, then distil off 8 quarts. Every 100 parts of this distillate is mixed with 75 parts of citric acid dissolved in 200 parts of water, colored with a trace of orange and filtered through talc. Each 200 parts of the filtrate is then mixed with 2 quarts of syrup.

II.—Twenty-five middle-sized lemons are thinly peeled, the peelings finely cut, and the whole, lemons and peels, put to macerate in a mixture of 3 pints 90 per cent alcohol and 5 quarts water. Let macerate for 24 hours. Add 10 drops lemon and 10 drops orange oil; then slowly distil off 4 quarts. The distillate will be turbid, but if left to stand in a cool, dark place for a week it will filter off clear, and should make a clear mixture with equal parts of water and simple syrup. If it does not, add with a pipette, drop by drop, sufficient alcohol to make it do so. Finally, dissolve in the mixture 4 drachms of vanillin, and color with a few drops of tincture of turmeric and a little caramel.

III.—Peel thinly and lightly, 25 medium-sized fresh lemons and 1 orange, and cut the peelings into very small pieces. Macerate in 55 drachms 96 per cent alcohol, for 6 hours. Filter off the macerate without pressing. Dilute the filtrate with 3 pints water and set aside for eight days, shaking frequently. At

the end of this time filter. The filtrate is usually clear, and if so, add 4 drachms of vanillin. If not, proceed as in the second formula above.

IV.—Oil of lemon, select, 8 fluidounces; oil of lemon grass (fresh), 1 fluidrachm; peel, freshly grated, of 12 lemons; alcohol, 7 pints; boiled water, 1 pint.

Mix and macerate for 7 days. If in a hurry for the product, percolate through the lemon peel and filter. The addition of any other substance than the oil and rind of the lemon is not recommended.

V.—Fresh oil of lemon	64	parts
Lemon peel (outer rind) freshly grated	32	parts
Oil of lemon grass	1	part
Alcohol	500	parts

Mix, let macerate for 14 days, and filter.

VI.—Essence of lemon	1¾	ounces
Rectified spirit of wine	6	ounces
Pure glycerine	3	ounces
Pure phosphate calcium	4	ounces
Distilled water to make	1	pint.

Mix essence of lemon, spirit of wine, glycerine, and 8 ounces of distilled water, agitate briskly in a quart bottle for 10 minutes, and introduce phosphate of calcium and again shake. Put in a filter and let it pass through twice. Digest in filtrate for 2 or 3 days, add 1½ ounces fresh lemon peel, and again filter.

VII.—Oil of lemon	6	parts
Lemon peel (freshly grated)	4	parts
Alcohol, sufficient.		

Dissolve the oil of lemon in 90 parts of alcohol, add the lemon peel, and macerate for 24 hours. Filter through paper, adding through the filter enough alcohol to make the filtrate weigh 100 parts.

VIII.—Exterior rind of lemon	2	ounces
Alcohol, 95 per cent, deodorized	32	ounces
Oil of lemon, recent	3	fluidounces

Expose the lemon rind to the air until perfectly dry, then bruise in a wedgwood mortar, and add it to the alcohol, agitating until the color is extracted; then add the lemon oil.

Natural Lemon Juice.—I.—Take 4.20 parts of crystallized citric acid; 2 parts essence of lemons; 3 parts of alcohol of 96 per cent; ½ part calcium carbonate; 50 parts sodium phosphate, and $\frac{1}{20}$ part calcium citrate, and dissolve the whole in sufficient water to make 60 parts.

II.—Squeeze out the lemon juice, strain it to get rid of the seeds and larger particles of pulp, etc., heat it to the boiling point, let it cool down, add talc, shake well together and filter. If it is to be kept a long time (as on a sea voyage) a little alcohol is added.

Limejuice.—This may be clarified by heating it either alone or mixed with a small quantity of egg albumen, in a suitable vessel, without stirring, to near the boiling point of water, until the impurities have coagulated and either risen to the top or sunk to the bottom. It is then filtered into clean bottles, which should be completely filled and closed (with pointed corks), so that each cork has to displace a portion of the liquid to be inserted. The bottles are sealed and kept at an even temperature (in a cellar). In this way the juice may be satisfactorily preserved.

Nutmeg Essence.—Oil of nutmeg, 2 drachms; mace, in powder, 1 ounce; alcohol, 95 per cent, deodorized, 32 ounces.

Dissolve the oil in the alcohol by agitation, add the mace, agitate, then stopper tightly, and macerate 12 hours. Filter through paper.

Orange Extract.—Grated peel of 24 oranges; alcohol, 1 quart; water, 1 quart; oil of orange, 4 drachms. Macerate the orange peel and oil of orange with alcohol for 2 weeks. Add distilled water and filter.

Orange Extract, Soluble.—I.—Pure oil of orange, 1¼ fluidounces; carbonate of magnesium, 2 ounces; alcohol, 12 fluidounces; water, quantity sufficient to make 2 pints.

II.—Dissolve oil of orange in the alcohol, and rub it with the carbonate of magnesium, in a mortar. Pour the mixture into a quart bottle, and fill the bottle with water. Allow to macerate for a week or more, shaking every day. Then filter through paper, adding enough water through the paper to make filtrate measure 2 pints.

Orange Peel, Soluble Extract.—

Freshly grated orange rind	1 part
Deodorized alcohol	1 part

Macerate for 4 days and express. Add the expressed liquid to 10 per cent of its weight of powdered magnesium carbonate

in a mortar, and rub thoroughly until a smooth, creamy mixture results; then gradually add the water, constantly stirring. Let stand for 48 hours, then filter through paper. Keep in an amber bottle and cool place. To make syrup of orange, add 1 part of this extract to 7 parts of heavy simple syrup.

Peach Extract.—

Linalyl formate	120 minims
Amyl valerianate	8 drachms
Fluid extract orris	2 ounces
Oenanthic ether	2 drachms
Oil rue (pure German)	30 minims
Chloroform	2 drachms
Glycerine	2 ounces

Alcohol, 70 per cent, to 3 pints.

Pineapple Essence.—A ripe, but not too soft, pineapple, weighing about, say, 1 pound, is mashed up in a mortar with Tokay wine, 6 ounces. The mass is then brought into a flask with 1 pint of water, and allowed to stand 2 hours. Alcohol, 90 per cent, ¾ pint, is then added and the mixture distilled until 7 quarts of distillate have been collected. Cognac, 9 ounces, is then added to the distillation.

Pistachio Essence.—

I.—Essence of almond	2	fluidounces
Tincture of vanilla	4	fluidounces
Oil of neroli	1	drop
II.—Oil of orange peel	4	fluidrachms
Oil of cassia	1	fluidrachm
Oil of bitter almond	15	minims
Oil of calamus	15	minims
Oil of nutmeg	1½	fluidrachms
Oil of clove	30	minims
Alcohol	12	fluidounces
Water	4	fluidounces
Magnesium carbonate	2	drachms

Shake together, allow to stand 24 hours, and filter.

Pomegranate Essence.—

Oil of sweet orange	3 parts
Oil of cloves	3 parts
Tincture of vanilla	15 parts
Tincture of ginger	10 parts
Maraschino liqueur	150 parts
Tincture of coccionella	165 parts
Distilled water	150 parts
Phosphoric acid, dilute	45 parts

Alcohol, 95 per cent, quantity sufficient to make 1,000 parts.

Mix and dissolve.

Quince Extract.—

Fluid extract orris	2 ounces
Oenanthic ether	1½ ounces
Linalyl formate	90 minims
Glycerine	2 ounces

Alcohol, 70 per cent, to 3 pints.

Raspberry Syrup, without Alcohol or Antiseptics.—The majority of producers of fruit juices are firmly convinced that the preservation of these juices without the addition of alcohol, salicylic acid, etc., is impossible. Herr Steiner's process to the contrary is here reproduced:

The fruit is crushed and pressed; the juice, with 2 per cent of sugar added, is poured into containers to about three-quarters of their capacity, and there allowed to ferment. The containers are stoppered with a cork through which runs a tube, whose open end is protected by a bit of gum tubing, the extremity of which is immersed in a glass filled with water. It should not go deeper than $\frac{1}{10}$ of an inch high. The evolution of carbonic gas begins in about 4 hours and is so sharp that the point of the tube must not be immersed any deeper.

Ordinarily fermentation ceases on the tenth day, a fact that may be ascertained by shaking the container sharply, when, if it has ceased, no bubbles of gas will appear on the surface of the water.

The fermented juice is then filtered to get rid of the pectinic matters, yeast, etc., and the filtrate should be poured back on the filter several times. The juice filters quickly and comes off very clear. The necessary amount of sugar to make a syrup is now added to the liquid and allowed to dissolve gradually for 12 hours. At the end of this time the liquid is put on the fire and allowed to boil up at once, by which operation the solution of the sugar is made complete. Straining through a tin strainer and filling into heated bottles completes the process.

The addition of sugar to the freshly pressed juice has the advantage of causing the fermentation to progress to the full limit, and also to preserve, by the alcohol produced by fermentation, the beautiful red color of the juice.

Any fermentation that may be permitted prior to the pressing out of the juices is at the expense of aroma and flavor; but whether fermentation occurs before or after pressure of the berry, the ordinary alcohol test cannot determine whether the juice has been completely fermented (and consequently whether the pectins have been completely separated) or not. Since, in spite of the fact that the liquid remains limpid after 4 days'

fermentation, the production of alcohol is progressing all the time—a demonstration that fermentation cannot then be completed, and that at least 10 days will be required for this purpose.

An abortive raspberry syrup is always due to an incomplete or faulty fermentation, for too often does it occur that incompletely fermented juices after a little time lose color and become turbid.

The habit of clarifying juices by shaking up with a bit of paper, talc, etc., or boiling with albumen is a useless waste of time and labor. By the process indicated the entire process of clarification occurs automatically, so to speak.

Deep Red Raspberry Syrup.—A much deeper and richer color than that ordinarily attained may be secured by adding to crushed raspberries, before fermentation, small quantities of sugar, sifted over the surface in layers. The ethylic alcohol produced by fermentation in this manner aids in the extraction of the red coloring matter of the fruit. Moreover, the fermented juice should never be cooked over a fire, but by superheated steam. Only in this way can caramelization be completely avoided. Only sugar free from ultramarine and chalk should be used in making the syrup, as these impurities also have a bad influence on the color.

Raspberry Essences.—

I.—Raspberries, fresh . . 16 ounces
Angelica (California) 6 fluidounces
Brandy (California) 6 ounces
Alcohol . . . . . 6 ounces
Water, quantity sufficient.

Mash the berries to a pulp in a mortar or bowl, and transfer to a flask, along with the Angelica, brandy, alcohol, and about 8 ounces of water. Let macerate overnight, then distil off until 32 ounces have passed over. Color red. The addition of a trifle of essence of vanilla improves this essence.

II.—Fresh raspberries . . . 200 grams
Water, distilled . . . . . 100 grams
Vanilla essence . . . . . 2 grams

Pulp the raspberries, let stand at a temperature of about 70° F. for 48 hours, and then add 100 grams of water. Fifty grams are then distilled off, and alcohol, 90 per cent, 25 grams, in which 0.01 vanillin has been previously dissolved, is added to the distillate.

Sarsaparilla, Soluble Extract.—

Pure oil of wintergreen . . . . . 5 fluidrachms
Pure oil of sassafras . . . . . 5 fluidrachms
Pure oil of anise . . 5 fluidrachms
Carbonate of magnesium . . . . . 2½ ounces
Alcohol . . . . . 1 pint
Water, quantity sufficient to make 2 pints.

Dissolve the various oils in the alcohol, and rub with carbonate of magnesium in a mortar. Pour the mixture into a quart bottle, and fill the bottle with water. Allow to macerate for a week or more, shaking every day. Then filter through the paper, adding enough water through the paper to make the finished product measure 2 pints.

Strawberry Juice.—Put into the water bath 1,000 parts of distilled water and 600 parts of sugar and boil, with constant skimming, until no more scum arises. Add 5 parts of citric acid and continue the boiling until about 1,250 parts are left. Stir in, little by little, 500 parts of fresh strawberries, properly stemmed, and be particularly careful not to crush the fruit. When all the berries are added, cover the vessel, remove from the fire, put into a warm place and let stand, closely covered, for 3 hours, or until the mass has cooled down to the surrounding temperature, then strain off through flannel, being careful not to crush the berries. Prepare a sufficient number of pint bottles by filling them with warm water, putting them into a kettle of the same and heating them to boiling, then rapidly emptying and draining as quickly as possible. Into these pour the hot juice, cork and seal the bottles as rapidly as possible. Juice thus prepared retains all the aroma and flavor of the fresh berry, and if carefully corked and sealed up will retain its properties a year.

Strawberry Essence.—

Strawberries, fresh . . 16 ounces
Angelica (California) 6 fluidounces
Brandy (California) . 6 ounces
Alcohol . . . . . 8 ounces
Water, quantity sufficient.

Mash the berries to a pulp in a mortar or bowl, and transfer to a flask, along with the Angelica, brandy, alcohol, and about 8 ounces of water. Let macerate overnight, then distil off until 32 ounces have passed over. Color strawberry red. The addition of a little essence of vanilla and a hint of lemon improves this essence.

Tea Extract.—

I.—

Best Souchong tea	175 parts
Cinnamon	3 parts
Cloves	3 parts
Vanilla	1 part
Arrack	800 parts
Rum	200 parts

Coarsely powder the cinnamon, clove, etc., mix the ingredients, and let macerate for 3 days, then filter, press off, and make up to 1,000 parts, if necessary, by adding rum. The Souchong may be replaced by any other brand of tea, and the place of the arrack may be occupied by Santa Cruz, or New England rum. The addition of fluid extract of kola nut not only improves the taste, but gives the drink a remarkably stimulating property. The preparation makes a clear solution with either hot or cold water and keeps well.

II.—Tea, any desirable variety, 16 ounces; glycerine, 4 ounces; hot water, 4 pints; water, sufficient to make 1 pint.

Reduce the tea to a powder, moisten with sufficient of the glycerine and alcohol mixed, with 4 ounces of water added, pack in percolator, and pour on the alcohol (diluted with glycerine and water) until 12 ounces of percolate have been obtained. Set this aside, and complete the percolation with the hot water. When this has passed through, evaporate to 4 ounces, and add it to the percolate first obtained.

Tonka Extract.—

Tonka beans	1 ounce
Magnesium carbonate, quantity sufficient.	
Balsam of Peru	2 drachms
Sugar	4 ounces
Alcohol	8 ounces
Water sufficient to make 16 ounces.	

Mix the tonka, balsam of Peru, and magnesia, and rub together, gradually adding the sugar until a homogeneous powder is obtained. Pack in a percolator; mix the alcohol with an equal amount of water, and pour over the powder, close the exit of the percolator, and let macerate for 24 to 36 hours, then open the percolator, and let pass through, gradually adding water until 16 ounces pass through.

Vanilla Extracts.—I.—Vanilla, in fine bits, 250 parts, is put into 1,350 parts of mixture, of 2,500 parts 95 per cent alcohol, and 1,500 parts distilled water. Cover tightly, put on the water bath, and digest for 1 hour, at 140° F. Pour off the liquid and set aside. To the residue in the bath, add half the remaining water, and treat in the same manner. Pack the vanilla in an extraction apparatus, and treat with 250 parts of alcohol and water, mixed in the same proportions as before. Mix the results of the three infusions first made, filter, and wash the filter paper with the results of the percolation, allowing the filtered percolate to mingle with the filtrate of the mixed infusions.

II.—Take 60 parts of the best vanilla beans, cut into little pieces, and put into a deep vessel, wrapped with a cloth to retain the heat as long as possible. Shake over the vanilla 1 part of potassium carbonate in powder, and immediately add 240 parts distilled water, in an active state of ebullition. Cover the vessel closely, set aside until it is completely cold, and then add 720 parts alcohol. Cover closely, and set aside in a moderately warm place for 15 days, when the liquid is strained off, the residue pressed, and the whole colate filtered. The addition of 1 part musk to the vanilla before pouring on the hot water improves this essence.

To prepare vanilla fountain syrup with extracts I or II, mix 25 minims of the extract with 1 pint simple syrup. Color with caramel.

III.—

Vanilla beans, cut fine	1 ounce
Sugar	3 ounces
Alcohol, 50 per cent.	1 pint

Beat sugar and vanilla together to a fine powder. Pour on the dilute alcohol, cork the vessel, and let stand for 2 weeks, shaking it up 2 or 3 times a day.

IV.—

Vanilla beans, chopped fine	30 parts
Potassium carbonate	1 part
Boiling water	1,450 parts
Alcohol	450 parts
Essence of musk	1 part

Dissolve the potassium carbonate in the boiling water, add the vanilla, cover the vessel, and let stand in a moderately warm place until cold. Transfer to a wide-mouthed jar, add the alcohol, cork, and let macerate for 15 days; then decant the clear essence and filter the remainder. Mix the two liquids and add the essence of musk.

V.—Cut 60 parts of best vanilla beans into small bits; put into a deep vessel, which should be well wrapped in a woolen cloth to retain heat as long as possible. Shake over the beans 1 part of potassium carbonate, in powder, then pour over the mass 240 parts distilled water, in an

active state of ebullition, cover the vessel closely, and set aside in a moderately warm place. When quite cold add 720 parts alcohol, close the vessel tightly, and set aside in a moderately warm place, to macerate for 15 days, then strain off, press out, and set aside for a day or two. The liquid may then be filtered and bottled. The addition of a little musk to the beans before pouring on the hot water, is thought by many to greatly improve the product. One part of this extract added to 300 parts simple syrup is excellent for fountain purposes.

VI.—Vanilla beans.....	8 ounces
Glycerine.....	6 ounces
Granulated sugar...	1 pound
Water.....	4 pints
Alcohol of cologne spirits.....	4 pints

Cut or grind the beans very fine; rub with the glycerine and put in a wooden keg; dissolve the sugar in the water, first heating the water, if convenient; mix the water and spirits, and add to the vanilla; pour in keg. Keep in a warm place from 3 to 6 months before using. Shake often. To clear, percolate through the dregs. If a dark, rich color is desired add a little sugar coloring.

VII.—Vanilla beans, good quality..	16 ounces
Alcohol.....	64 fluidounces
Glycerine.....	24 fluidounces
Water.....	10 fluidounces
Dilute alcohol, quantity sufficient.	

Mix and macerate, with frequent agitation, for 3 weeks, filter, and add dilute alcohol to make 1 gallon.

VIII.—Vanilla beans, good quality...	8 ounces
Pumice stone, lump.....	1 ounce
Rock candy.....	8 ounces
Alcohol and water, of each a sufficiency.	

Cut the beans to fine shreds and triturate well with the pumice stone and rock candy. Place the whole in a percolator and percolate with a menstruum composed of 9 parts alcohol and 7 parts water until the percolate passes through clear. Bring the bulk up to 1 gallon with the same menstruum and set aside to ripen.

IX.—Cut up, as finely as possible, 20 parts of vanilla bean and with 40 parts of milk sugar (rendered as dry as possible by being kept in a drying closet until it no longer loses weight) rub to a coarse powder. Moisten with 10 parts of dilute alcohol, pack somewhat loosely in a closed percolator and let stand for 2 hours. Add 40 parts of dilute alcohol, close the percolator, and let stand 8 days. At the end of this time add 110 parts of dilute alcohol, and let pass through. The residue will repay working over. Dry it well, add 5 parts of vanillin, and 110 parts of milk sugar and pass through a sieve, then treat as before.

The following are cheap extracts:

X.—Vanilla beans, chopped fine..	5 parts
Tonka beans, powdered.....	10 parts
Sugar, powdered.	14 parts
Alcohol, 95 per cent.....	25 parts
Water, quantity sufficient to make 100 parts.	

Rub the sugar and vanilla to a fine powder, add the tonka beans, and incorporate. Pack into a filter, and pour on 10 parts of alcohol, cut with 15 parts of water; close the faucet, and let macerate overnight. In the morning percolate with the remaining alcohol, added to 80 parts of water, until 100 parts of percolate pass through.

XI.—Vanilla beans.....	4 ounces
Tonka beans.....	8 ounces
Deodorized alcohol	8 pints
Simple syrup.....	2 pints

Cut and bruise the vanilla beans, afterwards bruising the tonka beans. Macerate for 14 days in one-half of the spirit, with occasional agitation. Pour off the clear liquor and set aside; pour the remaining spirits in the magma, and heat by means of the water bath to about 170° F. in a loosely covered vessel. Keep at this temperature 2 or 3 hours, and strain through flannel, with slight pressure. Mix the two portions of liquid, and filter through felt. Add the syrup

White Pine and Tar Syrup.—

White pine bark....	75 parts
Wild cherry bark....	75 parts
Spikenard root.....	10 parts
Balm of Gilead buds	10 parts
Sanguinaria root....	8 parts
Sassafras bark.....	7 parts
Sugar.....	750 parts
Chloroform.....	6 parts
Syrup of tar.....	75 parts
Alcohol, enough.	
Water, enough.	
Syrup enough to make 1,000 parts.	

Reduce the first six ingredients to a coarse powder and by using a menstruum composed of 1 in 3 alcohol, obtain 500 parts of a tincture from them. In this

dissolve the sugar, add the syrup of tar and the chloroform, and, finally, enough syrup to bring the measure of the finished product up to 1,000 parts.

Wild Cherry Extract.—

Oenanthic ether..	2 fluidrachms
Amyl acetate....	2 fluidrachms
Oil of bitter almonds (free from hydrocyanic acid)	1 fluidrachm
Fluid extract of wild cherry.....	3 fluidounces
Glycerine.....	2 fluidounces

Deodorized alcohol enough to make 16 fluidounces.

HARMLESS COLORS FOR USE IN SYRUPS, ETC.:

Red.—Cochineal syrup, prepared as follows:

I.—Cochineal in coarse powder.....	6 parts
Potassium carbonate.....	3 parts
Distilled water.....	15 parts
Alcohol, 95 per cent	12 parts

Simple syrup to make 500 parts.

Rub the cochineal and potassium together, adding the water and alcohol little by little, under constant trituration. Let stand overnight, add the syrup, and filter.

II.—Carmine, in fine powder.....	1 part
Stronger ammonia water.....	4 parts

Distilled water to make 24 parts.

Rub up the carmine and ammonia and to the solution add the water, little by little, under constant trituration. If in standing this shows a tendency to separate, a drop or two of ammonia will correct the trouble.

Besides these there is caramel, which, of course, you know.

Pink.—

III.—Carmine.....	1 part
Liquor potassæ....	6 parts
Distilled water.....	40 parts

Mix. If the color is too high, dilute with distilled water until the requisite color is obtained.

To Test Fruit Juices and Syrups for Aniline Colors.—Add to a sample of the syrup or juice, in a test tube, its own volume of distilled water, and agitate to get a thorough mixture, then add a few drops of the standard solution of lead diacetate, shake, and filter. If the syrup is free from aniline coloring matter the filtrate will be clear as crystal, since the lead salt precipitates natural coloring matters, but has no effect upon the aniline colors.

To Test Fruit Juices for Salicylic Acid.—Put a portion of the juice to be tested in a large test tube, add the same volume of ether, close the mouth of the tube and shake gently for 30 seconds. Set aside until the liquid separates into two layers. Draw off the supernatant ethereal portion and evaporate to dryness in a capsule. Dissolve the residue in alcohol, dilute with 3 volumes of water, and add 1 drop of tincture of iron chloride. If salicylic acid be present the characteristic purple color will instantly disappear.

Syrups Selected from the Formulary of the Pharmaceutical Society of Antwerp.—

Dionine Syrup.—Dionine, 1 part; distilled water, 19 parts; simple syrup, 1,980 parts. Mix.

Jaborandi Syrup.—Tincture of jaborandi, 1 part; simple syrup, 19 parts. Mix.

Convallaria Syrup.—Extract of convallaria, 1 part; distilled water, 4 parts; simple syrup, 95 parts. Dissolve the extract in the water and mix.

Codeine Phosphate Syrup.—Codeine phosphate, 3 parts; distilled water, 17 parts; simple syrup, 980 parts. Dissolve the codeine in the water and mix with the syrup.

Licorice Syrup.—Incised licorice root, 4 parts; dilute solution of ammonia, 1 part; water, 20 parts. Mix and macerate for 12 hours at 58° to 66° F. with frequent agitation; press, heat the liquid to boiling, then evaporate to two parts on the water bath; add alcohol, 2 parts; allow to stand for 12 hours; then filter. Add to the filtrate enough simple syrup to bring the final weight to 20 parts.

Maize Stigma Syrup.—Extract of maize stigmas, 1 part; distilled water, 4 parts; simple syrup, 95 parts. Dissolve the extract in the water, filter, and add the syrup.

Ammonium Valerianate Solution.—Ammonium valerianate, 2 parts; alcoholic extract of valerian, 1 part; distilled water, 47 parts.

Kola Tincture.—Powdered kola nuts, 1 part; alcohol, 60 per cent, 5 parts. Macerate for 6 days, press, and filter.

Bidet's Liquid Vesicant.—Tincture of cantharides, tincture of rosemary, chloroform, equal parts.

Peptone Wine.—Dried peptone, 1 part; Malaga wine, 19 parts. Dissolve without heat and filter after standing for several days.

Etching

General Instructions for Etching.—In etching, two factors come into consideration, (1) that which covers that part of the metal not exposed to the etching fluid (the resist), and (2) the etching fluid itself.

In the process, a distinction is to be made between etching in relief and etching in intaglio. In relief etching, the design is drawn or painted upon the surface with the liquid etching-ground, so that after etching and removal of the etching-ground, it appears raised. In intaglio etching, the whole surface is covered with the etching-ground, and the design put on with a needle; the ground being thus removed at the points touched by the drawing, the latter, after etching and removal of the etching-ground, is sunken.

Covering Agents or Resists.—The plate is enclosed by a border made of grafting wax (yellow beeswax, 8 parts; pine rosin, 10 parts; beef tallow, 2 parts; turpentine, 10 parts); or a mixture of yellow wax, 8 parts; lard, 3 parts; Burgundy pitch, ½ part. This mixture is also used to cover the sides of vessels to be etched. Another compound consists of wax, 5 parts; cobbler's wax, 2½ parts; turpentine, 1 part.

Etching-Ground. — I. — Soft: Wax, 2 parts; asphalt, 1 part; mastic, 1 part. II.—Wax, 3 parts; asphalt, 4 parts. III.—Mastic, 16 parts; Burgundy pitch, 50 parts; melted wax, 125 parts; and melted asphalt, 200 parts added successively, and, after cooling, turpentine oil, 500 parts. If the ground should be deep black, lampblack is added.

Hard: Burgundy pitch, 125 parts; rosin, 125 parts, melted; and walnut oil, 100 parts, added, the whole to be boiled until it can be drawn out into long threads.

Etching-Ground for Copper Engraving.—White wax, 120 parts; mastic, 15 parts; Burgundy pitch, 60 parts; Syrian asphalt, 120 parts, melted together; and 5 parts concentrated solution of rubber in rubber oil added.

Ground for Relief Etching.—I.—Syrian asphalt, 500 parts, dissolved in turpentine oil, 1,000 parts. II.—Asphalt, rosin, and wax, 200 parts of each, are melted, and dissolved in turpentine oil, 1,200 parts. The under side of the metal plate is protected by a coating of a spirituous shellac solution, or by a solution of asphalt, 300 parts, in benzol, 600 parts.

For Strongly Acid Solutions.—I.—Black pitch, 1 part; Japanese wax, 2 parts; rosin, 1½ parts; Damar rosin, 1 part, melted together and mixed with turpentine oil, 1 part. II.—Heavy black printers' ink, 3 parts; rosin, 1 part; wax, 1 part.

For electro-etching, the following ground is recommended: Wax, 4 parts; asphalt, 4 parts; pitch, 1 part.

If absolute surety is required respecting the resistance of the etching-ground to the action of the etching fluids, several etching-grounds are put on, one over the other; first (for instance), a solution of rubber in benzol, then a spirituous shellac solution, and a third stratum of asphalt dissolved in turpentine oil.

If the etching is to be of different degrees of depth, the places where it is to be faint are stopped out with varnish, after they are deep enough, and the object is put back into the bath for further etching.

For putting on a design before the etching, the following method may be used: Cover the metal plate, tin plate for example, with a colored or colorless spirit varnish; after drying, cover this, in a dark room, with a solution of gelatin, 5 parts, and red potassium chromate, 1 part, in water, 100 parts; or with a solution of albumen, 2 parts; ammonium bichromate, 2 parts, in water, 200 parts. After drying, put the plate, covered with a stencil, in a copying or printing frame, and expose to light. The sensitive gelatin stratum will become insoluble at the places exposed. Place in water, and the gelatin will be dissolved at the places covered by the stencil; dry, and remove the spirit varnish from the places with spirit, then put into the etching fluid.

Etching Fluids.—The etching fluid is usually poured over the metallic surface, which is enclosed in a border, as described before. If the whole object is to be put into the fluid, it must be entirely covered with the etching-ground. After etching it is washed with pure water, dried with a linen cloth, and the etching-ground is then washed off with turpentine oil or a light volatile camphor oil. The latter is very good for the purpose.

Etching Fluids for Iron and Steel.—I.—Pure nitric acid, diluted for light etching with 4 to 8 parts of water, for deep etching with an equal weight of water.

II.—Tartaric acid, 1 part, by weight; mercuric chloride, 15 parts, by weight; water, 420 parts; nitric acid, 16 to 20 drops, if 1 part equals 28½ grains.

III.—Spirit, 80 per cent, 120 parts, by weight; pure nitric acid, 8 parts; silver nitrate, 1 part.

IV.—Pure acetic acid, 30 per cent, 40 parts, by weight; absolute alcohol, 10 parts; pure nitric acid, 10 parts.

V.—Fuming nitric acid, 10 parts, by weight; pure acetic acid, 30 per cent, 50 parts, diluted with water if necessary or desired.

VI.—A chromic acid solution.

VII.—Bromine, 1 part; water, 100 parts. Or—mercuric chloride, 1 part; water, 30 parts.

VIII.—Antimonic chloride, 1 part; water, 6 parts; hydrochloric acid, 6 parts.

For Delicate Etchings on Steel.—I.—Iodine, 2 parts; potassium iodide, 4 parts; water, 40 parts.

II.—Silver acetate, 8 parts, by weight; alcohol, 250 parts; water, 250 parts; pure nitric acid, 260 parts; ether, 64 parts; oxalic acid, 4 parts.

III.—A copper chloride solution.

Etching Powder for Iron and Steel.—Blue vitriol, 50 parts; common salt, 50 parts; mixed and moistened with water.

For lustrous figures on a dull ground, as on sword blades, the whole surface is polished, the portions which are to remain bright covered with stencils and the object exposed to the fumes of nitric acid. This is best done by pouring sulphuric acid, 20 parts, over common salt, 10 parts.

Relief Etching of Copper, Steel, and Brass.—Instead of nitric acid, which has a tendency to lift up the etching-ground, by evolution of gases, it is better to use a mixture of potassium bichromate, 150 parts; water, 800 parts; and concentrated sulphuric acid, 200 parts. The etching is slow, but even, and there is no odor.

For Etching Copper, Brass, and Tombac.—Pure nitric acid diluted with water to 18° Bé. The bubbles of gas given out should immediately be removed with a feather that the etching may be even.

Another compound consists of a boiling solution of potassium chlorate, 2 parts, in water, 20 parts, poured into a mixture of nitric acid, 10 parts, and water, 70 parts. For delicate etchings dilute still more with 100 to 200 parts of water.

Etching Fluid for Copper.—Weak: A boiling solution of potassium chlorate, 20 parts, in water, 200 parts, poured into a mixture of pure hydrochloric acid, 20 parts; water, 500 parts.

Stronger: A boiling solution of potassium chlorate, 25 parts, in water, 250 parts, poured into a mixture of pure hydrochloric acid, 250 parts; water, 400 parts.

Very strong: A boiling solution of potassium chlorate, 30 parts, in water, 300 parts, poured into a mixture of pure hydrochloric acid, 300 parts; water, 300 parts.

For etching on copper a saturated solution of bromine in dilute hydrochloric acid may also be used; or a mixture of potassium bichromate, ½ part; water, 1 part; crude nitric acid, 3 parts.

The following are also much used for copper and copper alloys:

I.—A copper chloride solution acidified with hydrochloric acid.

II.—Copper nitrate dissolved in water.

III.—A ferric chloride solution of 30° to 45° Bé. If chrome gelatin or chrome albumen is used for the etching-ground, a spirituous ferric chloride solution is employed. The etching process can be made slower by adding common salt to the ferric chloride solution.

Matt Etching of Copper.—White vitriol, 1 to 5 parts; common salt, 1 part; concentrated sulphuric acid, 100 parts; nitric acid (36° Bé.), 200 parts, mixed together. The sulphuric acid is to be poured carefully into the nitric acid, not the reverse.

Etching Fluid for Brass.—Nitric acid, 8 parts; mixed with water, 80 parts; into this mixture pour a hot solution of potassium chlorate, 3 parts, in water, 50 parts.

Etching Fluid for Brass to Make Stencils.—Mix nitric acid, of 1.3 specific weight, with enough fuming nitric acid to give a deep yellow color. This mixture acts violently, and will eat through the strongest sheet brass.

Etching Fluid for Zinc.—Boil pounded gallnuts, 40 parts, with water, 560 parts, until the whole amounts to 200 parts; filter, and add nitric acid, 2 parts, and a few drops of hydrochloric acid. Ferric chloride and antimonic chloride solutions may also be used to etch zinc.

Relief Etching of Zinc.—The design is to be drawn with a solution of platinum chloride, 1 part, and rubber, 1 part, in water, 12 parts. The zinc plate is placed in dilute sulphuric acid (1 in 16). The black drawing will remain as it is.

Another compound for the drawing is made of blue vitriol, 2 parts; copper chloride, 3 parts; water, 64 parts; pure hydrochloric acid, 1.1 specific weight. After the drawing is made, lay the plate in dilute nitric acid (1 in 8).

Etching Fluid for Aluminum.—Dilute hydrochloric acid serves this purpose. Aluminum containing iron can be matted with soda lye, followed by treatment with nitric acid. The lye dissolves the aluminum, and the nitric acid dissolves the iron. Aluminum bronze is etched with nitric acid.

Etching Fluid for Tin or Pewter.—Ferric chloride, or highly diluted nitric acid.

Etching Fluids for Silver.—I.—Dilute pure nitric acid.

II.—Nitric acid (specific weight, 1.185), 172 parts; water, 320 parts; potassium bichromate, 30 parts.

Etching Fluid for Gold.—Dilute aqua regia (=nitric and sulphuric acids, in the proportion of 1 in 3).

Etching Fluid for Copper, Zinc, and Steel.—A mixture of 4 parts of acetic acid (30 per cent), and alcohol, 1 part; to this is added gradually, nitric acid, 1 part.

Etching Fluid for Lead, Antimony, and Britannia Metal.—Dilute nitric acid.

Etching Powder for Metals (Tin, Silver, Iron, German Silver, Copper, and Zinc).—Blue vitriol, 1 part; ferric oxide, 4 parts. The powder, moistened, is applied to the places to be etched, as, for instance, knife blades. Calcined green vitriol can also be used.

Electro-Etching.—This differs from ordinary etching in the use of a bath, which does not of itself affect the metal, but is made capable of doing so by the galvanic current.

Ordinary etching, seen under the microscope, consists of a succession of uneven depressions, which widen out considerably at a certain depth. In electro-etching, the line under the microscope appears as a perfectly even furrow, not eaten out beneath, however deeply cut. The work is, accordingly, finer and sharper; the fumes from the acids are also avoided, and the etching can be modified by regulation of the current. The preparation of the surface, by covering, stopping-out, etc., is the same as in ordinary etching. At some uncovered place a conducting wire is soldered on with soft solder, and covered with a coat of varnish. The plate is then suspended in the bath, and acts as the anode, with another similar plate for the cathode. If gradations in etching are desired, the plates are taken out after a time, rinsed, and covered, and returned to the bath.

For the bath dilute acids are used, or saline solutions. Thus, for copper, dilute sulphuric acid, 1 in 20. For copper and brass, a blue vitriol solution. For zinc, white vitriol or a zinc chloride solution. For steel and iron, green vitriol, or an ammonium chloride solution. For tin, a tin-salt solution. For silver, a silver nitrate or potassium cyanide solution. For gold and platinum, gold chloride and platinum chloride solutions, or a potassium cyanide solution. For electro-etching a Leclauché or Bunsen battery is to be recommended. In the former, the negative zinc pole is connected with a plate of the same metal as that to be etched, and the positive iron pole with the plate to be etched. In the Bunsen battery, the carbon pole is connected with the object to be etched, the zinc pole with the metal plate.

Etching Bath for Brass.—1.—Mix nitric acid (specified gravity, 1.4), 8 parts, with water, 80 parts. 2.—Chlorate of potash, 3 parts, dissolved in 50 parts of water. Mix 1 and 2. For protecting those portions which are not to be etched, any suitable acid-proof composition can be used.

Etching on Copper.—I.—In order to do regular and quick etching on copper take a copper plate silvered on the etching side. Trace on this plate, either with varnish or lithographic ink, the design. When the tracing is dry, place the plate in an iron bath, using a battery. The designs traced with the varnish or ink are not attacked by the etching fluid. When the plate is taken from the bath and has been washed and dried, remove the varnish or ink with essence of turpentine; next pour mercury on the places reserved by the varnish or ink; the mercury will attack the silvered portions and the etching is quickly made. When the mercury has done its duty gather up the excess and return to the bottle with a paper funnel. Wash the plate in strong alum water, and heat.

II.—The plate must be first polished either with emery or fine pumice stone, and after it has been dried with care, spread thereon a varnish composed of equal parts of yellow wax and essence of turpentine. The solution of the wax in the essence is accomplished in the cold; next a little oil of turpentine and some lampblack are added. This varnish is allowed to dry on, away from dust and humidity. When dry, trace the design with a very fine point. Make a border with modeling wax, so as to prevent the acid from running off. Pour on nitric acid if the plate is of copper, or

hydrochloric acid diluted with water if the plate is of zinc, allow the acid to act according to the desired depth of the engraving; wash several times and remove the varnish by heating the plate lightly. Wash with essence of turpentine and dry well in sawdust or in the stove. For relief engraving the designs are traced before the engraving on the plate with the resist varnish instead of covering the plate entirely. These designs must be delicately executed and without laps, as the acid eats away all the parts not protected by the varnish.

Etching Fluids for Copper.—I.—A new etching fluid for copper plate is hydrogen peroxide, to which a little dilute ammonia water is added. It is said to bite in very rapidly and with great regularity and uniformity.

II.—Another fluid is fuming hydrochloric acid (specific gravity, 1.19), 10 parts; water, 70 parts. To this add a solution of potassium chlorate, 2 parts, dissolved in 20 parts of hot water. If the articles to be etched are very delicate and fine this should be diluted with from 100 to 200 parts of water.

ETCHING ON GLASS.

Names, designs, etc., can be etched on glass in three ways: First, by means of an engraving wheel, a method which requires some manual skill. Second, by means of a sand blast, making a stencil of the name, fixing this on the glass, and then, by means of a blast of air, blowing sand on the glass. Third, by the use of hydrofluoric acid. The glass is covered with beeswax, paraffine wax, or some acid resisting ink or varnish; the name or device is then etched out of the wax by means of a knife, and the glass dipped in hydrofluoric acid, which eats away the glass at those parts where the wax has been cut away.

Fancy work, ornamental figures, lettering, and monograms are most easily and neatly cut into glass by the sand-blast process. Lines and figures on tubes, jars, etc., may be deeply etched by smearing the surface of the glass with beeswax, drawing the lines with a steel point, and exposing the glass to the fumes of hydrofluoric acid. This acid is obtained by putting powdered fluorspar into a tray made of sheet lead and pouring sulphuric acid on it, after which the tray is slightly warmed. The proportions will vary with the purity of the materials used, fluorspar (except when in crystals) being generally mixed with a large quantity of other matter. Enough acid to make a thin paste with the powdered spar will be about right. Where a lead tray is not at hand, the powdered spar may be poured on the glass and the acid poured on it and left for some time. As a general rule, the marks are opaque, but sometimes they are transparent. In this case cut them deeply and fill up with black varnish, if they are required to be very plain, as in the case of graduated vessels. Liquid hydrofluoric acid has been recommended for etching, but is not always suitable, as it leaves the surface on which it acts transparent.

There are two methods of marking bottles—dry etching, or by stamping with etching inks. The first process is usually followed in glass factories. A rubber stamp is necessary for this process, and the letters should be made as large and clean cut as possible without crowding them too much. Besides this, an etching powder is required.

A small quantity of the powder is poured into a porcelain dish, and this is placed on a sand bath or over a gentle fire, and heated until it is absolutely dry, so that it can be rubbed down to an impalpable powder.

The bottle or other glass to be marked must be perfectly clean and dry. The etching powder takes better when the vessel is somewhat warm. The stamp should be provided with a roller which is kept constantly supplied with a viscid oil which it distributes on the stamp and which the stamp transfers to the glass surface. The powder is dusted on the imprint thus made, by means of a camel's-hair brush. Any surplus falling on the unoiled surface may be removed with a fine long-haired pencil. The printed bottle is transferred to a damp place and kept for several minutes, the dampness aiding the etching powder in its work on the glass surface. The bottle is then well washed in plain water.

Glass cylinders, large flasks, carboys, etc., may be treated in a somewhat different manner. The stamp here is inserted, face upward, between two horizontal boards, in such a manner that its face projects about a quarter of a millimeter (say 0.01 inch) above the surface. Oil is applied to the surface, after which the cylinder, carboy, or what not, is rolled along the board and over the stamp. The design is thus neatly transferred to the glass surface, and the rest of the operation is as in the previous case.

For an etching ink for glassware the following is recommended:

Ammonium fluoride..	2 drachms
Barium sulphate.....	2 drachms

Reduce to a fine powder in a mortar,

then transfer to a lead dish and make into a thin writing-cream with hydrofluoric acid or fuming sulphuric acid. Use a piece of lead to stir the mixture. The ink may be put up in bottles coated with paraffine, which can be done by heating the bottle, pouring in some melted paraffine, and letting it flow all around. The writing is done with a quill, and in about half a minute the ink is washed off.

Extreme caution must be observed in handling the acid, since when brought in contact with the skin it produces dangerous sores very difficult to heal. The vapor is also dangerously poisonous when inhaled.

Hydrofluoric Formulas.—I.—Dissolve about 0.72 ounces fluoride of soda with 0.14 ounces sulphate of potash in ½ pint of water. Make another solution of 0.28 ounces chloride of zinc and 1.30 ounces hydrochloric acid in an equal quantity of water. Mix the solutions and apply to the glass vessel with a pin or brush. At the end of half an hour the design should be sufficiently etched.

II.—A mixture consisting of ammonium fluoride, common salt, and carbonate of soda is prepared, and then placed in a gutta-percha bottle containing fuming hydrofluoric acid and concentrated sulphuric acid. In a separate vessel which is made of lead, potassium fluoride is mixed with hydrochloric acid, and a little of this solution is added to the former, along with a small quantity of sodium silicate and ammonia. Some of the solution is dropped upon a rubber pad, and by means of a suitable rubber stamp, bearing the design which is to be reproduced, is transferred to the glass vessel that is to be etched.

Etching with Wax.—Spread wax or a preservative varnish on the glass, and trace on this wax or varnish the letters or designs. If letters are desired, trace them by hand or by the use of letters cut out in tin, which apply on the wax, the inside contours being taken with a fine point. When this is done, remove the excess of wax from the glass, leaving only the full wax letters undisturbed. Make an edge of wax all along the glass plate so as to prevent the acid from running over when you pour it on to attack the glass. At the end of 3 to 4 hours remove the acid, wash the glass well with hot water, next pour on essence of turpentine or alcohol to take off the wax or the preservative varnish. Pass again through clean water; the glass plate will have become dead wherever the acid has eaten in, only the letters remaining polished. For fancy designs it suffices to put on the back of the plate a black or colored varnish, or tin foil, etc., to obtain a brilliant effect.

Etching Glass by Means of Glue.—It is necessary only to cover a piece of ordinary or flint glass with a coat of glue dissolved in water in order to see that the layer of glue, upon contracting through the effect of drying, becomes detached from the glass and removes therefrom numerous scales of varying thickness. The glass thus etched presents a sort of regular and decorative design similar to the flowers of frost deposited on window-panes in winter. When salts that are readily crystallizable and that exert no chemical action upon the gelatin are dissolved in the latter the figures etched upon the glass exhibit a crystalline appearance that recalls fern fronds.

Hyposulphite of soda and chlorate and nitrate of potash produce nearly the same effects. A large number of mineral substances are attacked by gelatin. Toughened glass is easily etched, and the same is the case with fluorspar and polished marble. A piece of rock crystal, cut at right angles with the axis and coated with isinglass, the action of which seems to be particularly energetic, is likewise attacked at different points, and the parts detached present a conchoidal appearance. The contraction of the gelatin may be rendered visible by applying a coating of glue to sheets of cardboard or lead, which bend backward in drying and assume the form of an irregular cylinder.

Such etching of glass and different mineral substances by the action of gelatin may be employed for the decoration of numerous objects.

Dissolve some common glue in ordinary water, heated by a water bath, and add 6 per cent of its weight of potash alum. After the glue has become perfectly melted, homogeneous, and of the consistency of syrup, apply a layer, while it is still hot, to a glass object by means of a brush. If the object is of ground glass the action of the glue will be still more energetic. After half an hour apply a second coat in such a way as to obtain a smooth, transparent surface destitute of air bubbles. After the glue has become so hard that it no longer yields to the pressure of the finger nail (say, in about 24 hours), put the article in a warmer place, in which the temperature must not exceed 105° F. When the object is removed from the oven, after a few hours, the glue will detach itself with

a noise and removes with it numerous flakes of glass. All that the piece then requires is to be carefully washed and dried.

The designs thus obtained are not always the same, the thickness of the coat of glue, the time of drying, and various other conditions seeming to act to modify the form and number of the flakes detached.

It is indispensable to employ glass objects of adequate thickness, since, in covering mousseline glass with a layer of glue, the mechanical action that it has to support during desiccation is so powerful that it will break with an explosion. Glue, therefore, must not be allowed to dry in glass vessels, since they would be corroded and broken in a short time.

Indelible Labels on Bottles.—To affix indelible labels on bottles an etching liquid is employed which is produced as follows:

Liquid I, in one bottle.—Dissolve 36 parts of sodium fluoride in 500 parts of distilled water and add 7 parts of potassium sulphate.

Liquid II, in another bottle.—Dissolve zinc chloride, 14 parts, in 500 parts of distilled water, and add 65 parts of concentrated hydrochloric acid.

For use mix equal parts together and add a little dissolved India ink to render the writing more visible.

The mixing cannot, however, be conducted in a vessel. It is best to use a cube of paraffine which has been hollowed out.

Etching on Marble or Ivory (see also Ivory).—Cover the objects with a coat of wax dissolved in 90 per cent alcohol, then trace the desired designs by removing the wax with a sharp tool and distribute on the tracing the following mixture: Hydrochloric acid, 1 part; acetic acid, 1 part. Repeat this operation several times, until the desired depth is attained. Then take off the varnish with alcohol. The etching may be embellished, filling up the hollows with any colored varnish, by wiping the surface with a piece of linen fixed on a stick, to rub the varnish into the cavities after it has been applied with a brush. The hollows may be gilded or silvered by substituting "mixtion" for the varnish and applying on this mixtion a leaf of gold or silver, cut in pieces a little larger than the design to be covered; press down the gold by means of a soft brush so as to cause it to penetrate to the bottom; let dry and remove the protruding edges.

Etching on Steel.—The print should be heavily inked and powdered with dragon's blood several times. After each powdering heat slightly and additional powder will stick, forming a heavy coating in 2 or 3 operations. Before proceeding to heat up, the plate should receive a light etching in a weak solution of the acid described later on. The purpose of this preliminary etching is to clean up the print, so that the lines will not tend to thicken, as would be the case otherwise. Next a good strong heating should be given. On top the dragon's blood plumbago may be used in addition. For etching use nitric acid mixed with an even amount of acetic acid. Some operators use vinegar, based on the same theory. When commencing the etching, start with a weak solution and increase as soon as the plate is deep enough to allow another powdering. If the operator is familiar with lithography, and understands rolling up the print with a litho-roller, the etching of steel is not harder than etching on zinc.

Liquids for Etching Steel.—

I.—Iodine	2	parts
Potassium iodide	5	parts
Water	40	parts
II.—Nitric acid	60	parts
Water	120	parts
Alcohol	200	parts
Copper nitrate	8	parts
III.—Glacial acetic acid	4	parts
Nitric acid	1	part
Alcohol	1	part

IV.—Mix 1 ounce sulphate of copper, ¼ ounce alum, ½ teaspoonful of salt (reduced to powder), with 1 gill of vinegar and 20 drops of nitric acid. This fluid can be used either for etching deeply or for frosting, according to the time it is allowed to act. The parts of the work which are not to be etched should be protected with beeswax or some similar substance.

V.—Nitric acid, 60 parts; water, 120 parts; alcohol, 200 parts; and copper nitrate, 8 parts. Keep in a glass-stoppered bottle. To use the fluid, cover the surface to be marked with a thin even coat of wax and mark the lines with a machinist's scriber. Wrap clean cotton waste around the end of the scriber or a stick, and dip in the fluid, applying it to the marked surface. In a few minutes the wax may be scraped off, when fine lines will appear where the scriber marked the wax. The drippings from a lighted wax candle can be used for the

coating, and this may be evenly spread with a knife heated in the candle flame.

VI.—For Hardened Steel.—Heat an iron or an old pillar-file with a smooth side, and with it spread a thin, even coat of beeswax over the brightened surface to be etched. With a sharp lead pencil (which is preferable to a scriber) write or mark as wanted through the wax so as to be sure to strike the steel surface. Then daub on with a stick etching acid made as follows: Nitric acid, 3 parts; muriatic acid, 1 part. If a lead pencil has been used the acid will begin to bubble immediately. Two or three minutes of the bubbling or foaming will be sufficient for marking; then soak up the acid with a small piece of blotting paper and remove the beeswax with a piece of cotton waste wet with benzine, and if the piece be small enough dip it into a saturated solution of sal soda, or if the piece be large swab over it with a piece of waste. This neutralizes the remaining acid and prevents rusting, which oil will not do.

If it is desired to coat the piece with beeswax without heating it, dissolve pure beeswax in benzine until of the consistency of thick cream and pour on to the steel, and even spread it by rocking or blowing, and lay aside for it to harden; then use the lead pencil, etc., as before. This method will take longer. Keep work from near the fire or an open flame.

EUCALYPTUS BONBONS FOR COLDS AND COUGHS:

See Cold and Cough Mixtures.

EXPECTORANTS:

See Cold and Cough Mixtures.

Explosives

Explosives may be divided into two great classes—mechanical mixtures and chemical compounds. In the former the combustible substances are intimately mixed with some oxygen supplying material, as in the case of gunpowder, where carbon and sulphur are intimately mixed with potassium nitrate; while gun cotton and nitro-glycerine are examples of the latter class, where each molecule of the substance contains the necessary oxygen for the oxidation of the carbon and hydrogen present, the oxygen being in feeble combination with nitrogen. Many explosives are, however, mechanical mixtures of compounds which are themselves explosive, e. g., cordite, which is mainly composed of gun cotton and nitro-glycerine.

The most common and familiar of explosives is undoubtedly gunpowder. The mixture first adopted appears to have consisted of equal parts of the three ingredients—sulphur, charcoal, and niter; but some time later the proportions, even now taken for all ordinary purposes, were introduced, namely:

Potassium nitrate....	75 parts
Charcoal.....	15 parts
Sulphur.....	10 parts
	100 parts

Since gunpowder is a mechanical mixture, it is clear that the first aim of the maker must be to obtain perfect incorporation, and, necessarily, in order to obtain this, the materials must be in a very finely divided state. Moreover, in order that uniformity of effect may be obtained, purity of the original substances, the percentage of moisture present, and the density of the finished powder are of importance.

The weighed quantities of the ingredients are first mixed in gun metal or copper drums, having blades in the interior capable of working in the opposite direction to that in which the drum itself is traveling. After passing through a sieve, the mixture (green charge) is passed on to the incorporating mills, where it is thoroughly ground under heavy metal rollers, a small quantity of water being added to prevent dust and facilitating incorporation, and during this process the risk of explosion is greater possibly than at any other stage in the manufacture. There are usually 6 mills working in the same building, with partitions between. Over the bed of each mill is a horizontal board, the "flash board," which is connected with a tank of water overhead, the arrangement being such that the upsetting of one tank discharges the contents of the other tanks onto the corresponding mill beds below, so that in the event of an accident the charge is drowned in each case. The "mill cake" is now broken down between rollers, the "meal" produced being placed in strong oak boxes and subjected to hydraulic pressure, thus increasing its density and hardness, at the same time bringing the ingredients into more intimate contact. After once more breaking down the material (press cake), the powder only requires special treatment to adapt it for the various purposes for which it is intended.

The products of the combustion of powder and its manner of burning are

largely influenced by the pressure, a property well illustrated by the failure of a red-hot platinum wire to ignite a mass of powder in a vacuum, only a few grains actually in contact with the platinum undergoing combustion.

Nitro-glycerine is a substance of a similar chemical nature to gun cotton, the principles of its formation and purification being very similar, only in this case the materials and product are liquids, thereby rendering the operations of manufacture and washing much less difficult. The glycerine is sprayed into the acid mixture by compressed-air injectors, care being taken that the temperature during nitration does not rise above 86° F. The nitro-glycerine formed readily separates from the mixed acids, and being insoluble in cold water, the washing is comparatively simple.

Nitro-glycerine is an oily liquid readily soluble in most organic solvents, but becomes solid at 3° or 4° above the freezing point of water, and in this condition is less sensitive. It detonates when heated to 500° F., or by a sudden blow, yielding carbon dioxide, oxygen, nitrogen, and water. Being a fluid under ordinary conditions, its uses as an explosive were limited, and Alfred Nobel conceived the idea of mixing it with other substances which would act as absorbents, first using charcoal and afterwards an infusorial earth, "kieselguhr," and obtaining what he termed "dynamite." Nobel found that "collodion cotton"—soluble gun cotton—could be converted by treatment with nitro-glycerine into a jellylike mass which was more trustworthy in action than the components alone, and from its nature the substance was christened "blasting gelatin."

Nobel took out a patent for a smokeless powder for use in guns, in which these ingredients were adopted with or without the use of retarding agents. The powders of this class are ballistite and filite, the former being in sheets, the latter in threads. Originally camphor was introduced, but its use has been abandoned, a small quantity of aniline taking its place.

Sir Frederick Abel and Prof. Dewar patented in 1889 the use of trinitro-cellulose and nitro-glycerine, for although, as is well known, this form of nitro-cellulose is not soluble in nitro-glycerine, yet by dissolving the bodies in a mutual solvent, perfect incorporation can be attained. Acetone is the solvent used in the preparation of "cordite," and for all ammunition except blank charges a certain proportion of vaseline is also added. The combustion of the powder without vaseline gives products so free from solid or liquid substances that excessive friction of the projectile in the gun causes rapid wearing of the rifling, and it is chiefly to overcome this that the vaseline is introduced, for on explosion a thin film of solid matter is deposited in the gun, and acts as a lubricant.

The proportion of the ingredients are:

Nitro-glycerine	58 parts
Gun-cotton.	37 parts
Vaseline.....	5 parts

Gun cotton to be used for cordite is prepared as previously described, but the alkali is omitted, and the mass is not submitted to great pressure, to avoid making it so dense that ready absorption of nitro-glycerine would not take place. The nitro-glycerine is poured over the dried gun cotton and first well mixed by hand, afterwards in a kneading machine with the requisite quantity of acetone for 3½ hours. A water jacket is provided, since, on mixing, the temperature rises. The vaseline is now added, and the kneading continued for a similar period. The cordite paste is first subjected to a preliminary pressing, and is finally forced through a hole of the proper size in a plate either by hand or by hydraulic pressure. The smaller sizes are wound on drums, while the larger cordite is cut off in suitable lengths, the drums and cut material being dried at 100° F., thus driving off the remainder of the acetone.

Cordite varies from yellow to dark brown in color, according to its thickness. When ignited it burns with a strong flame, which may be extinguished by a vigorous puff of air. Macnab and Ristori give the yield of permanent gases from English cordite as 647 cubic centimeters, containing a much higher per cent of carbon monoxide than the gases evolved from the old form of powder. Sir Andrew Noble failed in attempts to detonate the substance, and a rifle bullet fired into the mass only caused it to burn quietly.

Dynamite.—Dynamite is ordinarily made up of 75 per cent nitro-glycerine, 25 per cent infusorial earth; dualine contains 80 per cent nitro-glycerine, 20 per cent nitro-cellulose; rend-rock has 40 per cent nitro-glycerine, 40 per cent nitrate of potash, 13 per cent cellulose, 7 per cent paraffine; giant powder, 36 per cent nitro-glycerine, 48 per cent nitrate of potash, 8 per cent sulphur, 8 per cent rosin or charcoal.

Smokeless Powder.—The base of smokeless powders is nitrated cellulose,

which has been treated in one of various ways to make it burn slower than gun cotton, and also to render it less sensitive to heat and shocks. As a rule, these powders are not only less inflammable than gun cotton, but require stronger detonators. As metallic salts cause smoke, they are not used in these powders. The smokeless powders now in use may be divided into three groups: (1) Those consisting of mixtures of nitro-glycerine and nitrated cellulose, which have been converted into a hard, hornlike mass, either with or without the aid of a solvent. To this group belongs ballistite, containing 50 per cent of nitro-glycerine, 49 per cent of nitrated cellulose, and 1 per cent of diphenylamin; also cordite (see further on), Lenord's powder, and amberite. This last contains 40 parts of nitro-glycerine and 56 parts of nitrated cellulose. (2) Those consisting mainly of nitrated cellulose of any kind, which has been rendered hard and horny by treatment with some solvent which is afterwards evaporated. These are prepared by treating nitrated cellulose with ether or benzine, which dissolves the collodion, and when evaporated leaves a hard film of collodion on the surface of each grain. Sometimes a little camphor is added to the solvent, and, remaining in the powder, greatly retards its combustion. (3) Those consisting of nitro-derivatives of the aromatic hydrocarbons, either with or without the admixture of nitrated cellulose; to this group belong Dupont's powder, consisting of nitrated cellulose dissolved in nitro-benzine; indurite, consisting of cellulose hexanitrate (freed from collodion by extraction with methyl alcohol), made into a paste with nitro-benzine, and hardened by treatment with steam until the excess of nitro-benzine is removed; and plastomeite, consisting of dinitrotoluene and nitrated wood pulp.

Cordite is the specific name of a smokeless powder which has been adopted by the English government as a military explosive. It contains nitro-glycerine, 58 parts; gun cotton, 37 parts; and petrolatum, 5 parts. The nitro-glycerine and gun cotton are first mixed, 19.2 parts of acetone added, and the pasty mass kneaded for several hours. The petrolatum is then added and the mixture again kneaded. The paste is then forced through fine openings to form threads, which are dried at about 105° F. until the acetone evaporates. The threads, which resemble brown twine, are then cut into short lengths for use.

Another process for the manufacture of smokeless powder is as follows: Straw, preferably oat-straw, is treated in the usual way with a mixture of nitric acid and concentrated sulphuric acid, and then washed in water to free it from these, then boiled with water, and again with a solution of potassium carbonate. It is next subjected, for 2 to 6 hours, to the action of a solution composed of 1,000 parts of water, 12.5 parts of potassium nitrate, 3.5 parts of potassium chlorate, 12.5 parts of zinc sulphate, and 12.5 parts of potassium permanganate. The excess of solution is pressed out, and the mass is then pulverized, granulated, and finally dried.

The warning as to the danger of experimenting with the manufacture of ordinary gunpowder applies with renewed force when nitro-glycerine is the subject of the experiment.

Berge's Blasting Powder.—This is composed of chlorate of potash, 1 part; chromate of potash, 0.1 part; sugar, 0.45 parts; yellow wax, 0.09 parts. The proportions indicated may vary within certain limits, according to the force desired. For the preparation, the chlorate and the chromate of potash, as well as the sugar, are ground separately and very finely, and sifted so that the grains of the different substances may have the same size. At first any two of the substances are mixed as thoroughly as possible, then the third is added. The yellow wax, cut in small pieces, is finally added, and all the substances are worked together to produce a homogeneous product. The sugar may be replaced with charcoal or any other combustible body. For commercial needs, the compound may be colored with any inert matter, also pulverized.

Safety in Explosives.—Ammoniacal salts have been used in the manufacture of explosives to render them proof against firedamp, but not with the full success desired. Ammonium chloride has been utilized, but inconveniences are met with, and the vapor is quite disagreeable. In coöperation with equivalent quantities of soda and potash, its action is regarded as favorable. Tests employing benzine vapor and coal dust were made, and the comparative security calculated to be as given below.

I.—Donarite, composed as follows: 80 per cent of nitrate of ammonia, 12 of trinitrotoluol, 4 of flour, 3.8 of nitro-glycerine, and 0.2 per cent of cotton collodion. Security: Donarite alone, 87 parts; 95 per cent of donarite and 5 per

cent of ammonium chloride, 125 parts; 90 per cent of donarite and 10 per cent of ammonium chloride, 250 parts; 86 per cent of donarite and 5.5 per cent of ammonium chloride, with 8.5 per cent of nitrate of soda, 425 parts. The force of the explosion is decreased about 8 per cent, while the security is quintupled.

II.—Roburite, with the following composition: 72.5 per cent nitrate of ammonia; 12 binitro-benzol; 10 nitrate of potash; 5 sulphate of ammonia; 0.5 per cent permanganate of potash. Security: Roburite only, 325 parts; ammonium chloride, taking the place of sulphate of ammonia, 400 parts. Here an intensification of the explosive force is simultaneously produced.

III.—Ammon carbonite I, composed thus: 4 per cent nitro-glycerine; 75.5 nitrate of ammonia; 9.5 nitrate of potash; 9.5 coal dust; 10.5 flour. Security: Ammon carbonite I only, 250 parts; 95 per cent A. C. I. and 5 per cent ammonium chloride, 400 parts; 92 per cent A. C. I. and 8 per cent ammonium chloride, 500 parts. The addition of 5 per cent ammonium chloride diminishes the explosive force only 3 per cent.

IV.—An explosive of nitro-glycerine base composed thus: 30 per cent nitro-glycerine; 1 per cent cotton collodion; 52.6 nitrate of ammonia; 13 nitrate of potash; 3 to 4 per cent starch. Security of this mixture, 150 parts.

V.—Thirty per cent nitro-glycerine; 1 per cent cotton collodion; 47.3 nitrate of ammonia; 11.6 nitrate of potash; 3.1 starch; 7 per cent ammonium chloride. This mixture has a security of 350 parts.

Inflammable Explosive with Chlorate of Potash.—Take as an agent promoting combustion, potassium chlorate; as a combustible agent, an oxidized, nitrated, or natural rosin. If, to such a mixture, another body is added in order to render it soft and plastic, such as oil, nitro-benzine, glucose, glycerine, the benefit of the discovery is lost, for the mixture is rendered combustible with nitro-benzine, fecula, sulphur, etc., and inexplosive with glycerine, glucose, and the oil.

Of all the chlorates and perchlorates, potassium chlorate ($KClO_3$) responds the best to what is desired. As to the rosins, they may be varied, or even mixed. To obtain the oxidation or nitration of the rosins, they are heated with nitric acid, more or less concentrated, and with or without the addition of sulphuric acid. An oxidation, sufficient and without danger, can be secured by a simple and practical means. This is boiling them for several hours in water containing nitric acid, which is renewed from time to time in correspondence with its decomposition. The rosins recommended by M. Turpin are of the terebinthine group, having for average formula $C_{20}H_{30}O_2$. Colophony is the type.

The products, thus nitrated, are washed with boiling water, and, on occasion, by a solution slightly alkaline, with a final washing with pure water, and dried at a temperature of 230° F. or in the open air.

The mixing of the constituents of this explosive is preferably cold. For this purpose they are used in the state of fine powder, and when mixed in the tub, 2½ to 5 per cent of a volatile dissolvent is added, as alcohol, carbon sulphide, ether, or benzine. As soon as thoroughly mingled, the mass is put either in an ordinary grainer, or in a cylinder of wire cloth revolving horizontally on its axis, with glass gobilles forming a screen, by the aid of which the graining is rapidly accomplished. Thus a powder more or less finely granulated is produced free from dust.

The proportions preferably employed are:

1. Potassium chlorate... 85 parts
   Natural rosin..... 15 parts
2. Potassium chlorate... 80 parts
   Nitrated rosin..... 20 parts

For employment in firedamp mines, there is added to these compounds from 20 to 40 per cent of one of the following substances: Ammonium oxalate, ammonium carbonate, oxalic acid, sodium bicarbonate, calcium fluoride, or other substance of the nature to lower sufficiently the temperature of the explosive flame.

Gun Cotton.—For the production of a high-grade gun cotton, it is important that the cotton used should approach as near as possible pure cellulose. The waste from cotton mills, thoroughly purified, is usually employed. After careful chemical examination has been made to ascertain its freedom from grease and other impurities, the cotton waste is picked over by hand to remove such impurities as wood, cardboard, string, etc. The cotton is then passed through the "teasing machine," which opens out all knots and lumps, thereby reducing it to a state more suitable for the acid treatment and exposing to view any foreign substances which may have escaped notice in the previous picking. The cotton is then dried. When per-

fectly dry, it is removed to air-tight iron cases, in which it is allowed to cool. The iron cases are taken to the dipping houses, and the cotton waste weighed into small portions, which are then transferred as rapidly as possible to the mixed acids, allowed to remain a few minutes, then removed to the grating and the excess of acid squeezed out. The cotton now containing about ten times its weight of acid is placed in an earthenware pot and transferred to the steeping pits, where it is allowed to remain for 24 hours, a low temperature being maintained by a stream of cold water.

The cotton is now wholly converted into nitro-cellulose. The superfluous acid is next removed by a centrifugal extractor, after which the gun cotton is taken out of the machine and immediately immersed in a large volume of water, and thoroughly washed until it shows no acid reaction. The moisture is then run out and the gun cotton is conveyed by tramway to the boiling vats, where it undergoes several boilings by means of steam. When the "heat test" shows that a sufficient degree of stability has been obtained, the gun cotton is removed to a beating engine, and reduced to a very fine state of division. When this process is completed the pulp is run by gravity along wooden shoots, provided with "grit traps" and electro-magnets, which catch any traces of sand, iron, etc., into large "poachers," in which the gun cotton is continuously agitated, together with a large quantity of water. In this way it is thoroughly washed and a blend made of a large quantity of gun cotton.

Soluble Gun Cotton.—Soluble gun cotton is made on the same lines, except that greater attention has to be paid to the physical condition of the cotton used, and to the temperature and strength of acid mixture, etc.

The term "soluble" usually implies that the gun cotton is dissolved by a mixture of ethyl-ether and ethyl-alcohol, 2 parts of the former to 1 of the latter being the proportions which yield the best solvent action. The classification of nitro-celluloses according to their solubility in ether-alcohol is misleading, except when the nitrogen contents are also quoted.

The number of solvents for gun cotton which have at various times been proposed is very large. Among the more important may be mentioned the following: Alcohols (used chiefly in conjunction with other solvents), methyl, ethyl, propyl, and amyl, methyl-amyl ether, acetic ether, di-ethyl-ketone, methyl-ethyl ketone, amyl nitrate and acetate, nitro-benzole, nitro-toluol, nitrated oils, glacial acetic acid, camphor dissolved in alcohol, etc.

Some of the above may be called selective solvents, i. e., they dissolve one particular variety of gun cotton better than others, so that solubility in any given solvent must not be used to indicate solubility in another. No nitro-cotton is entirely soluble in any solvent. The solution, after standing some time, always deposits a small amount of insoluble matter. Therefore, in making collodion solutions, care should be taken to place the containing bottles in a place free from vibration and shock. After standing a few weeks the clear supernatant liquid may be decanted off. On a larger scale collodion solutions are filtered under pressure through layers of tightly packed cotton wool. The state of division is important. When the end in view is the production of a strong film or thread, it is advisable to use unpulped or only slightly pulped nitro-cellulose. In this condition it also dissolves more easily than the finely pulped material.

FULMINATES:

Fulminating Antimony.—Tartar emetic (dried), 100 parts; lampblack or charcoal powder, 3 parts. Triturate together, put into a crucible that it will three-fourths fill (previously rubbed inside with charcoal powder). Cover it with a layer of dry charcoal powder, and lute on the cover. After 3 hours' exposure to a strong heat in a reverberatory furnace, and 6 or 7 hours' cooling, cautiously transfer the solid contents of the crucible, as quickly as possible, without breaking, to a wide-mouthed stoppered phial, where, after some time, it will spontaneously crumble to a powder. When the above process is properly conducted, the resulting powder contains potassium, and fulminates violently on contact with water. A piece the size of a pea introduced into a mass of gunpowder explodes it on being thrown into water, or on its being moistened in any other manner.

Fulminating Bismuth.—Take bismuth, 120 parts; carbureted cream of tartar, 60 parts; niter, 1 part.

Fulminating Copper.—Digest copper (in powder of filings) with fulminate of mercury or of silver, and a little water.